RESEARCH ARTICLE

Descriptive Study of Tibia Shaft Fracture Treatment with Intramedullary (SIGN) Nail in Wazir Mohammad Akbar Khan Hospital from March 2023 to September 2024

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Received: 28/10/2026 **Accepted:** 29/10/2026 **Published:** 00/00/2026

Abstract

Introduction: Tibial shaft fractures are among the most common and disabling long-bone injuries encountered in orthopedic practice due to the subcutaneous location and weight-bearing nature of the tibia. **Material and Methods:** This descriptive case-series study evaluated 70 patients with closed or Gustilo–Anderson Type I/II open tibial shaft fractures treated with Surgical Implant Generation Network (SIGN) intramedullary nails at Wazir Mohammad Akbar Khan Hospital between March 21, 2023, and September 21, 2024. In total, 196,931 patients attended the hospital, with 17,471 admitted to the Orthopedics and Traumatology Department, from which 70 consecutive eligible cases were enrolled. Data on patient demographics, fracture mechanisms, treatment outcomes, complications, and follow-up were retrieved from admission registers and analyzed using Microsoft Excel. **Results and Discussion:** Results revealed that the majority of patients belonged to the 16–25-year age group (n=30, 42.86%), and males comprised 55 cases (78.57%). Laborers formed the largest occupational category (n=25, 35.71%), and 40 patients (57.14%) resided in Kabul city. Falls were the predominant injury mechanism (n=30, 42.86%), followed by road traffic accidents (n=25, 35.71%), plate fixation failure (n=10, 14.29%), and external fixation failure (n=5, 7.14%). Regarding clinical outcomes, 40 patients (57.14%) achieved an excellent result, 20 (28.57%) had a good outcome, and 10 (14.29%) had a poor outcome. Postoperative complications were absent in 50 cases (71.43%), whereas infection occurred in 15 cases (21.43%) and nonunion in 5 cases (7.14%). Follow-up at 6 weeks was attended by 30 patients (42.86%), 20 patients (28.57%) were evaluated at 12 weeks, and 20 patients (28.57%) had no follow-up recorded. **Conclusion:** In conclusion, SIGN intramedullary nailing demonstrated favorable therapeutic outcomes and low complication rates for tibial diaphyseal fractures in young active males. Standardized postoperative follow-up systems and occupational injury prevention strategies remain essential to optimize long-term clinical recovery.

Keywords: Tibial shaft fractures, SIGN intramedullary nail, Closed reamed intramedullary nailing, Interlocking intramedullary nail, Fracture union.

Journal of Applied Pharmaceutical Sciences and Research, (2026); DOI: 10.31069/japsr.v9i4.02

Introduction

Tibial fractures are among the most common fractures encountered in orthopedic practice[1] . Despite appropriate treatment, tibial fractures may result in prolonged morbidity and significant disability because the tibia is one of the longest bones in the body and one of its principal weight-bearing bones[2] . Tibial shaft fractures are relatively common and have been recognized as disabling injuries for centuries. Because of the subcutaneous location of the tibia, many tibial fractures are open. Associated injuries may include compartment syndrome, ankle injuries, and ligament injuries[3] . The treatment of these fractures varies according to the extent of soft-tissue damage. Before the modern era of antibiotics and aseptic surgical techniques, open tibial fractures could result in amputation or death[4] .

Compared with fractures of other bones, tibial fractures have relatively high rates of nonunion and malunion. Approximately 80% of tibial fractures are associated with fibular fractures. Because of its anatomical location, the tibia is particularly vulnerable to injury and is among the long bones most frequently affected by fractures[5,6] .

Some authors have reported that treatment of tibial shaft fractures with casts and braces is an effective method for managing many tibial shaft fractures and may prevent serious complications associated with surgical intervention[7] . According to the AO classification, tibial shaft fractures are classified into Type A (simple), Type B (wedge), and Type C (complex). Theoretically, intramedullary nail insertion from below the tibial tuberosity to a point approximately 4 cm proximal to the ankle joint is feasible[8] .

The present study investigated the pattern and frequency of tibial shaft fractures, the factors associated with their occurrence, and the outcomes of treatment using SIGN intramedullary nails at Wazir Mohammad Akbar Khan Hospital during the years 2023 and 2024 of the Solar Hijri

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calendar. This study was designed as a case series. Data were collected retrospectively from the medical records of patients admitted with tibial shaft fractures between 2023/03/21 and 2024/09/21.

Research Question

This research study questions that "What are the pattern and frequency of tibial shaft fractures and the outcomes of their treatment using SIGN intramedullary nails at Wazir Mohammad Akbar Khan Hospital during the period from 2023/03/21 to 2024/09/21"?

Significance and Rationale of the Study

Tibial shaft fractures commonly occur as a result of high-energy trauma and may be associated with injuries to multiple body systems[9,10] . Several treatment methods are available for tibial fractures, and orthopedic surgeons must be familiar with the advantages, disadvantages, and limitations of each treatment method in order to select the most appropriate approach for each patient.

The choice of treatment depends on factors including: type and location of the fracture, degree of fragmentation, patient age, and socioeconomic circumstances. Hospital admission and prolonged immobilization may increase the risk of complications, ranging from constipation to atelectasis, osteoporosis, and fatal pulmonary embolism[11] .

Possible operative and nonoperative treatment methods include closed reduction with cast immobilization, skeletal traction, functional bracing, external fixation, plate fixation, and locked intramedullary nailing. Currently, locked intramedullary nailing is considered the treatment of choice for most tibial shaft fractures[12] .

Goal and Objectives of the Study

The primary goal of the study was to investigate the pattern, frequency, and treatment outcomes of tibial shaft fractures using SIGN intramedullary nails among patients presenting to Wazir Mohammad Akbar Khan Hospital during the study period. Specific objectives included assessing distribution across age, sex, occupation, residence, injury mechanism, complications, outcomes, and follow-up status.

METHODS

This descriptive case-series study was conducted in the Department of Orthopedics and Traumatology at Wazir Mohammad Akbar Khan Hospital. During 2023 and 2024, out of 196,931 presenting patients, 17,471 were admitted to the Orthopedics Department[13,14] . Among these, a total sample of 70 patients with tibial shaft fractures treated with SIGN intramedullary nails between March 21, 2023, and September 21, 2024, were enrolled consecutively.

Inclusion and Exclusion Criteria

Inclusion criteria comprised patients older than 16 years with closed tibial shaft fractures (AO/OTA Types A, B, C) or Gustilo–Anderson Type I/II open fractures, as well as cases of tibial nonunion, malunion, or failed plate/external fixation. Exclusion criteria comprised patients younger than 16 years, concomitant distal/proximal articular fractures (pilon or plateau), Gustilo–Anderson Type III open fractures, active infections, or fractures managed conservatively or with plate fixation alone.

Data Collection and Analysis

Data were extracted from patient admission registers and medical records onto a predesigned data collection form covering age, sex, occupation, address, cause of injury, treatment type, complications, prognosis, and follow-up. Microsoft Excel was used for descriptive data organization and statistical frequency analysis[15,16] .

Ethical Considerations

Ethical clearance was obtained from the Hospital Scientific Council and Specialty Council of the Ministry of Public Health. Strict patient confidentiality was maintained in accordance with ethical medical standards.

Results

Distribution of Patients According to age

A total of 70 patients with tibial shaft fractures treated with SIGN intramedullary nails were included in the final analysis. Below are the structured tables and graphical representations of the data. Distribution of patients according to age has been given in Table 1 and Figure 1.

Distribution of Patients According to Sex

Distribution of patients according to sex has been given in Table 2 and Figure 2.

Table 1: Distribution of Patients According to Age

Age Group (years)	*Frequency (n)*	*Percentage (%)*
16–25	30	42.86%
26–40	25	35.71%
40 and above	15	21.43%
Total	70	100.00%

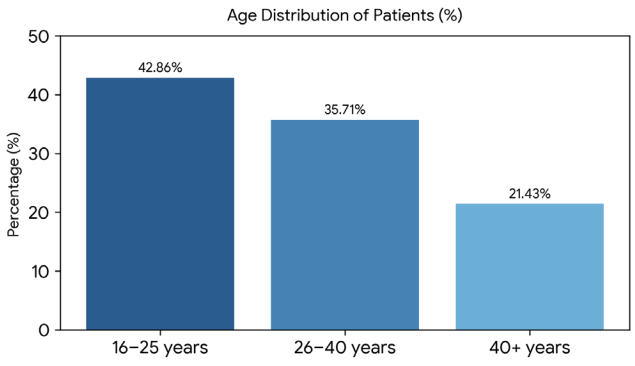


Figure 1: Percentage Distribution of Patients According to Age Group

Table 2: Distribution of patients according to sex

Sex	*Frequency (n)*	*Percentage (%)*
Male	55	78.57%
Female	15	21.43%
Total	70	100.00%

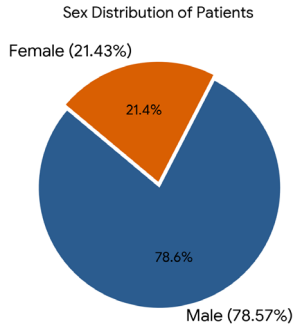


Figure 2: Percentage Distribution of Patients According to Sex

Distribution of Patients According to Occupation

Distribution of patients according to occupation has been given in Table 3 and Figure 3.

Distribution of Patients According to Place of Residence

Distribution of patients according to residence has been given in Table 4 and Figure 4.

Distribution of Patients According to Cause / Mechanism of Injury

Distribution of patients according to injury mechanism has been given in Table 5 and Figure 5.

Table 3: Distribution of patients according to occupation

Occupation	*Frequency (n)*	*Percentage (%)*
Laborers	25	35.71%
Farmers	20	28.57%
Employees	15	21.43%
Students	10	14.29%
Total	70	100.00%

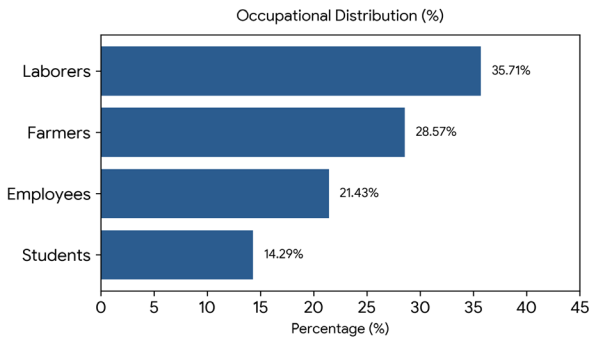


Figure 3: Percentage Distribution of Patients According to Occupation

Table 4: Distribution of patients according to residence

Place of Residence	*Frequency (n)*	*Percentage (%)*
Kabul City	40	57.14%
Surrounding Districts	20	28.57%
Other Provinces	10	14.29%
Total	70	100.00%

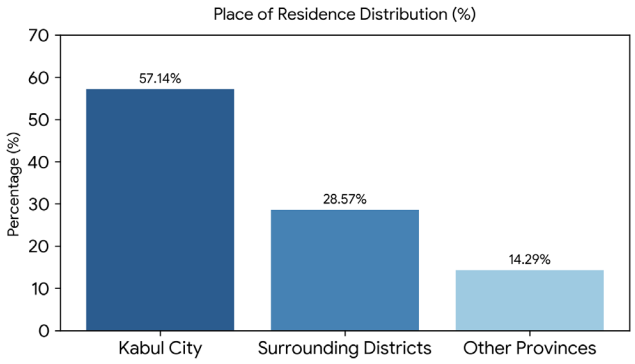


Figure 4: Percentage Distribution of Patients According to Residence

Distribution of Patients According to Treatment Outcome

Distribution of patients according to treatment outcome has been given in Table 6 and Figure 6.

Distribution of Patients According to Complications

Distribution of patients according to complications has been given in Table 7 and Figure 7.

Distribution of Patients According to Follow-up Status

Distribution of patients according to follow up status has been given in Table 8 and Figure 8.

Table 5: Distribution of patients according to cause of injury

Cause / Injury Mechanism	*Frequency (n)*	*Percentage (%)*
Fall	30	42.86%
Road Traffic Accident (RTA)	25	35.71%
Plate Fixation Failure	10	14.29%
External Fixation Failure	5	7.14%
Total	70	100.00%

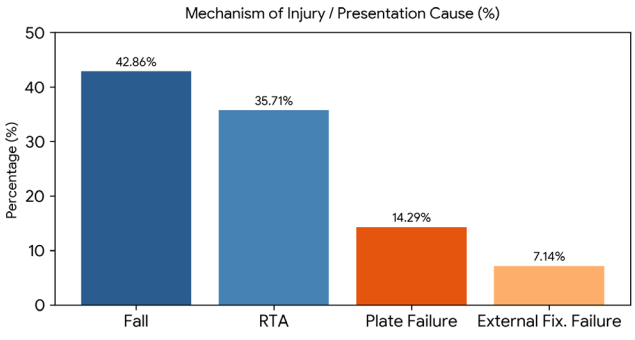


Figure 5: Distribution According to Cause of Injury or Presentation

Table 6: Distribution of patients according to treatment outcome

Treatment outcome	*Frequency (n)*	*Percentage (%)*
Excellent	40	57.14%
Good	20	28.57%
Poor	10	14.29%
Total	70	100.00%

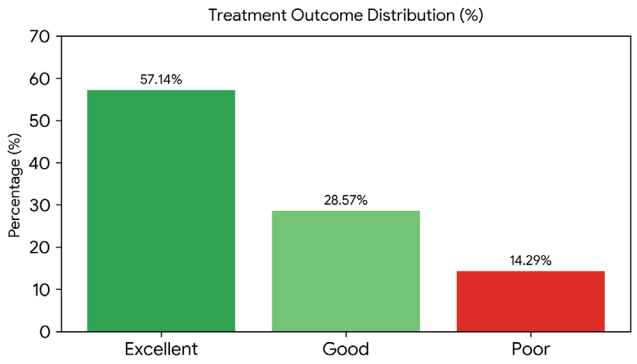


Figure 6: Percentage Distribution of Patients According to Treatment Outcome

Table 7: Distribution of patients according to complications

Complication Status	*Frequency (n)*	*Percentage (%)*
No Complications	50	71.43%
Infection	15	21.43%
Nonunion	5	7.14%
Total	70	100.00%

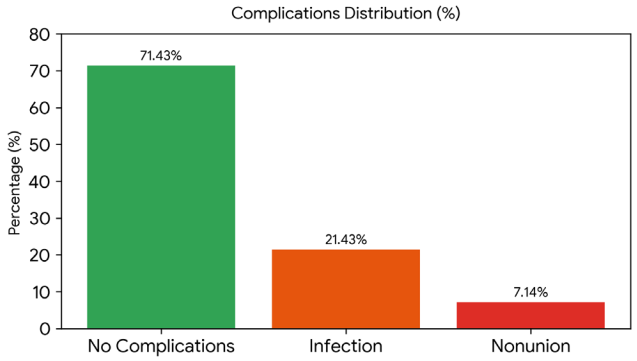


Figure 7: Percentage Distribution of Patients According to Complications

Table 8: Distribution of patients according to follow up status

Follow-up Status	*Frequency (n)*	*Percentage (%)*
Follow-up at 6 weeks	30	42.86%
Follow-up at 12 weeks	20	28.57%
No follow-up recorded	20	28.57%
Total	70	100.00%

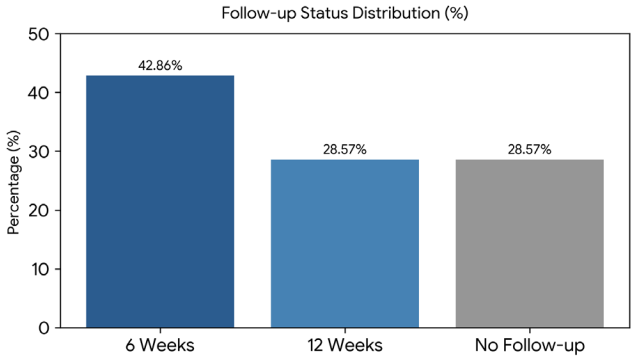


Figure 8: Percentage Distribution of Patients According to Follow-up Status

Future Prospectives

The future prospects of SIGN nailing can be strengthened through a comprehensive approach focusing on occupational injury prevention, improved road and traffic safety, and the development of accessible rural trauma care facilities. Expanding safety awareness among laborers and manual workers, enforcing workplace safety regulations, and promoting responsible road use may help reduce the incidence of fractures and other traumatic injuries. Establishing mobile orthopedic clinics, upgrading regional trauma centers, and improving access to specialized surgical services can ensure timely and effective treatment for patients in underserved areas. Furthermore, implementing structured postoperative follow-up systems for SIGN nail recipients can improve treatment adherence, facilitate early detection of complications, and reduce loss to follow-up. Regular clinical audits of previous fixation failures may help refine surgical indications and techniques, while prospective multicenter studies comparing SIGN nailing with alternative fixation methods can provide stronger evidence regarding clinical outcomes, cost-effectiveness, and long-term functional recovery. These initiatives may ultimately enhance the safety, accessibility, and effectiveness of SIGN nailing, particularly in resource-limited healthcare settings.

Conclusion

The findings of this study suggest that treatment of tibial shaft fractures using a SIGN intramedullary nail at Wazir Mohammad Akbar Khan Hospital was associated with favorable recorded outcomes in many of the included cases. The largest age group was 16–25 years. Men accounted for a larger proportion of cases than women, and laborers formed the largest occupational group. More patients came from Kabul city than from surrounding districts or other provinces, which may reflect proximity to and access to the hospital.

Falls were the most frequently recorded injury mechanism, followed by road traffic accidents; plate failure and external-fixator failure should be analyzed separately as treatment-related problems. An excellent outcome was recorded in 40 patients (57.14%), a good outcome in 20 (28.57%), and a

poor outcome in 10 (14.29%). No complication was recorded in 50 patients (71.43%), while infection and nonunion were recorded in 15 (21.43%) and 5 (7.14%), respectively. Follow-up was incomplete, with 20 patients (28.57%) having no follow-up recorded. These findings support the importance of standardized outcome assessment and postoperative follow-up.

Conflict of Interest

Authors declare none conflict of interest.

Acknowledgement

Authors want to thank management of their organization for conducting this study.

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How to cite this article: Rahim M, Abdullah MS, Hakimi SR. Descriptive Study of Tibia Shaft Fracture Treatment with Intramedullary (SIGN) Nail in Wazir Mohammad Akbar Khan Hospital from March 2023 to September 2024. Journal of Applied Pharmaceutical Sciences and Research. 2026; 9(4): 1-5 Doi : 10.31069/japsr.v9i4.02